

Alabama Ground Operations during the Deep Convective Clouds and Chemistry Experiment

Lawrence Carey¹, Richard Blakeslee², William Koshak², Lamont Bain¹, Ryan Rogers¹, Danielle Kozlowski¹, Adam Sherrer¹, Matt Saari¹, Brandon Bigelbach³, Mariana Scott¹, Elise Schultz¹, Chris Schultz^{1,2}, Patrick Gatlin^{1,2}, Matt Wingo¹, Dustin Phillips¹, Chris Phillips¹, Harold Peterson², Jeff Bailey¹, Terryn Frederickson¹, John Hall¹, Nicole Bart³, Melissa Becker³, Kurtis Pinkney³, Scott Rowe³, Mariusz Starzec³, Justin Weber³, and Gretchen Mullendore³

¹ *University of Alabama in Huntsville*

² *NASA MSFC*

³ *University of North Dakota*

The Deep Convective Clouds and Chemistry (DC3) field campaign investigates the impact of deep, mid-latitude convective clouds, including their dynamical, physical and lightning processes, on upper tropospheric composition and chemistry. DC3 science operations took place from 14 May to 30 June 2012. The DC3 field campaign utilized instrumented aircraft and ground-based observations. The NCAR Gulfstream-V (GV) observed a variety of gas-phase species, radiation and cloud particle characteristics in the high-altitude outflow of storms while the NASA DC-8 characterized the convective inflow. Ground-based radar networks were used to document the kinematic and microphysical characteristics of storms. In order to study the impact of lightning on convective outflow composition, VHF-based lightning mapping arrays (LMAs) provided detailed three-dimensional measurements of flashes. Mobile soundings were utilized to characterize the meteorological environment of the convection. Radar, sounding and lightning observations were also used in real-time to provide forecasting and mission guidance to the aircraft operations. Combined aircraft and ground-based observations were conducted at three locations, 1) northeastern Colorado, 2) Oklahoma/Texas and 3) northern Alabama, to study different modes of deep convection in a variety of meteorological and chemical environments.

The objective of this paper is to summarize the Alabama ground operations and provide a preliminary assessment of the ground-based observations collected over northern Alabama during DC3. The multi-Doppler, dual-polarization radar network consisted of the UAHuntsville Advanced Radar for Meteorological and Operational Research (ARMOR), the UAHuntsville Mobile Alabama X-band (MAX) radar and the Hytop (KHTX) Weather Surveillance Radar 88 Doppler (WSR-88D). Lightning frequency and structure were observed in near real-time by the NASA MSFC Northern Alabama LMA (NALMA). Pre-storm and inflow proximity soundings were obtained with the UAHuntsville mobile sounding unit and the Redstone Arsenal (QAG) morning sounding.

Daily convective weather forecasts for Alabama were generated to support mission planning by the DC3 Principal Investigators (PIs) stationed in Salina, KS. On potential convective weather days over Alabama, the mobile sounding unit and MAX radar were often deployed to support the other fixed radar, lightning and sounding assets. Ground-based operations were conducted over Alabama on twelve different storm days during DC3, including two aircraft missions on 21 May and 11 June. A variety of convective modes were sampled, including isolated ordinary convection, no-to-low flash rate shallow convection,

vigorous to severe multicell thunderstorms including some with linear organization, and nocturnal mesoscale convective systems (MCS's). On 21 May, conditions during the first aircraft mission favored both ordinary as well as linear convection across northeastern Alabama and adjacent sections of Tennessee. During the second aircraft mission of 11 June, multicellular convection was sampled across much of southern Tennessee and northern Alabama. Other convective events of note sampled by the ground-based network include a leading line, trailing stratiform (LLTS) MCS during the overnight hours from 3 to 4 June and a nocturnal, leading stratiform MCS passage on 5 June.